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THE PHYSICAL ASPECTS OF STROKE TEXTURE

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ABSTRACT: This paper examines Dr. Rudolph Pophal's concepts regarding the personality implications of the internal structure of the stroke. Four sets of experiments were designed to determine the relative importance played by the physical forces of pen, ink, and paper surface versus personality in producing variations in the stroke texture. All results were photographed at magnifications of 17.5X to 50X, and pertinent examples are reproduced.

The results indicate that physical forces are primarily responsible for the appearance of the pattern in the interior of the stroke. The role of personality was very limited and evident only in the effects of pressure variation on texture density. The findings do not support Pophal's conclusions, and offer an alternate explanation for differences in stroke texture.

Stroke texture is a concept originally formulated by Dr. Rudolph Pophal, a highly regarded neurologist and graphologist working in the 1940s to 1960s [1]. It is part of the triad of ductus assessment: width, borders, and texture, and is considered by many as an important indicator of basic personality structure.

The texture or quality of the stroke is defined as the central patterning of the ink contained within the edges of the stroke (Figure 1). It excludes all other facets of the stroke including pressure. Indeed it is only the stroke without pressure, or release stroke, that Pophal considered pertinent [2]. In order to appreciate the details of stroke texture it is mandatory to examine the material with at least 16x magnification. Higher powers of 30-50X permit even greater detail to be evaluated.

Another precondition for stroke interpretation required the writer to use a pen of their own choosing, or one with which they were entirely comfortable [2].

Pophal described three types of stroke texture: homogeneous, granulated, and amorphous [3]. Tables 1-3 provide descriptions of each type and their attendant personality implications as translated and summarized by Thea Stein Lewinson. Figure 2 depicts the appearance of each of the three types [4].

It was also observed by Dr. Pophal that a writer could not voluntarily alter the quality of the stroke [2].

Throughout this paper all references to "stroke" are narrowly limited to the internal ink-patterning or texture, and do not include any other aspect of stroke makeup.

TABLE 1
The Homogeneous Stroke ("woven stroke")

A. Appearance
- Integrated structure with internal differentiation
- Organically formed
- Woven, enlivened, animated, homogeneous-differentiated
- Firm, dense, coherent
- Intimate and close coherence of pigment particles
- Clear, transparent, simple
- Clean, neat, quiet, even
- Rhythmic exchange between lighter and darker parts
- Conveying the impression of a plane of ribbon

B. Interpretation
- Inner firmness, stability
- Even formative principle
- Inner solidity and "soundness"
- Reliability, trustworthy, faithful to own standards
- Simplicity
- Inner clarity and cleanliness
- Enlivened multifariousness (many-sidedness)

TABLE 2
The Granulated Stroke ("porous stroke")

A. Appearance
- Unintegrated with lack of internal differentiation
- Unorganically formed
- Not animated, mechanical, unhomogeneous-undifferentiated
- Loosened, dissolved, perforated, not firm, porous
- Diffusion of pigment, dissolving of pigment
- Unclear, dim, unevenly brightened
- Granulated, mottled, spotty, washed out, burned out
- Agitated, flickering, uneven, "moldy"
- Usually some depth penetration, "knitted" stroke

B. Interpretation
- Lack of inner firmness
- Inner looseness, instability
- Inner brittleness, lack of substance
- "Lack of character," weakness, unreliability
- Unprincipled, not faithful to own standards
- Excitability, lack of harmony

TABLE 3
The Amorphous Stroke (brush-like stroke)

A. Appearance
- Integrated structure without internal differentiation
- Homogeneous-undifferentiated
- Lifeless, dead, uniform, monotonous
- Monochromatic, pigment diminished by melting
- Dim, opaque
- Mostly conveying the impression of a plane

B. Interpretation
- Lack of emotional-intellectual differentiation
- Uninterested uniformity
- Leveling uniformity
- Indifference, boring
- Lack of liveliness and emotional content-sobriety
- Psychic monotony
- Simple, primitive psychic activity
- "Lack of character," weakness, unreliability

Tables 1, 2 and 3 describe Pophal's three types of stroke texture: homogenous, granulated and amorphous.

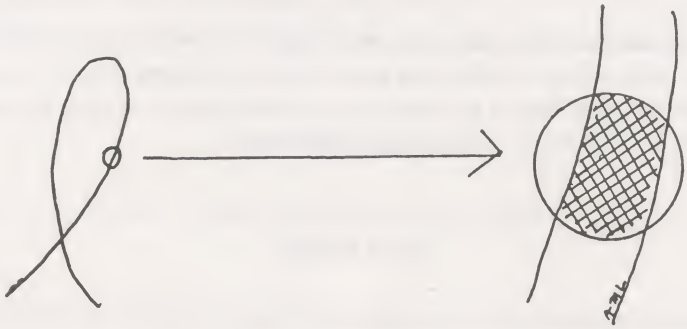
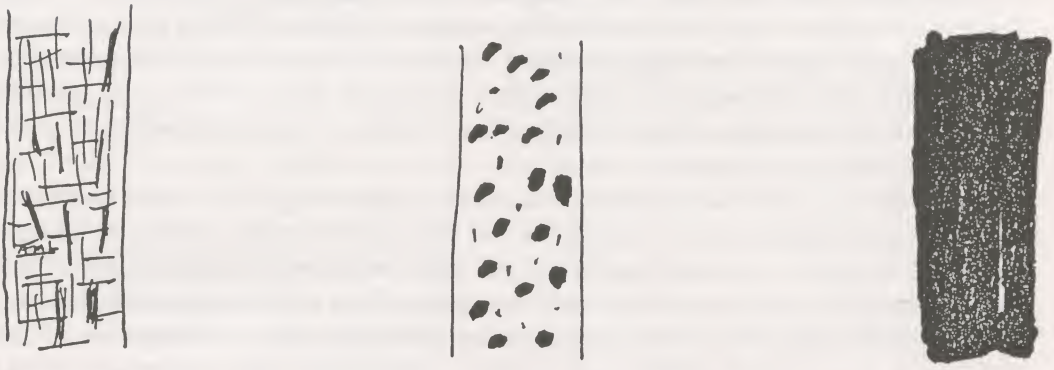


Figure 1. **Location of stroke texture magnified 16x.**



Homogeneous **Granular** **Amorphous**

Figure 2. **Pophal's three stroke types.**

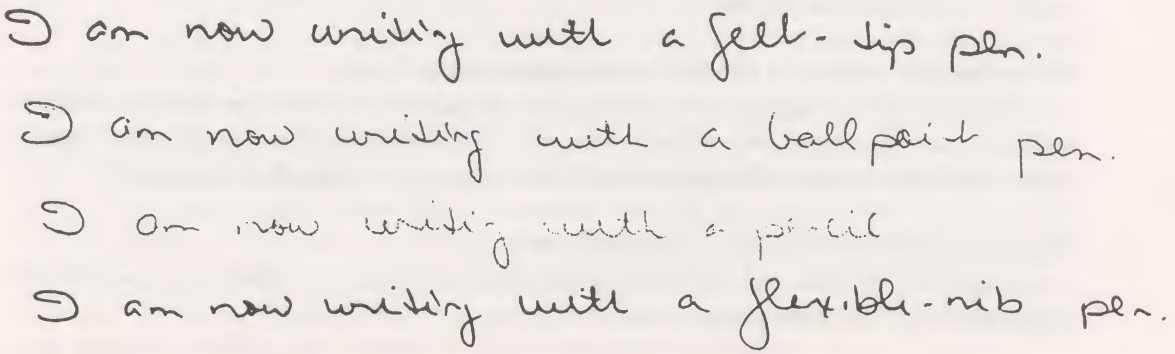


Figure 3. **The writer writes the same sentence with different pens.**

PURPOSE

The primary reason for this study was to re-examine the theory of stroke texture. The emphasis was on delineating the physical parameters concerned with the internal structure of the stroke and included forces generated by the interaction of pen, ink and paper. Was personality or physics the major determinant of texture?

METHODS

Four experiments were devised to examine the physical factors concerned with creating stroke texture. All samples were examined under magnifications of 16x to 50x.

Experiment 1: One Writer, Varying Instruments and Papers

Each subject used four different writing instruments on three different types of paper. The five participants each wrote with a ballpoint pen, a nib pen, a felt-tip pen and a pencil. The three paper types were highly textured, moderately textured, and smooth-surfaced, nonabsorbent. On each paper the subject wrote, "I am now writing with a _____," filling in the blank with the name of the instrument used. In some instances the nib pen was used twice on a given paper (Figure 3).

The stroke texture of each specimen was examined stereoscopically with a slitlamp biomicroscope at magnifications between 16x and 30x. Representative areas were then photographed through a microscope at 17.5X and 50X on Kodachrome film using a 35mm single lens reflex camera and macro lens. An external light source was used to illuminate the paper from above. The problem of image blur secondary to the extremely narrow depth of field was overcome by stabilizing the focal area of the paper. This was accomplished by using an inexpensive stationery-store plastic stencil of various sized circles. The area to be photographed was isolated well within an appropriate circle. Mild pressure on the stencil prevented movement of the paper vertically and thus permitted accurate focusing to be achieved with the microscope.

Experiment 2: Different Writers, Same Instrument and Paper

Thirty nine writers signed their names using the same nib pen on one sheet of paper; 34 different subjects signed their names on another identical paper all using the same ballpoint pen. The stroke texture was examined and photographed as in the first experiment.

Experiment 3: Attempt To Change the Texture

Using both ballpoint and nib pens on a single sheet of paper, efforts were made by the author to vary the internal structure of the stroke.

Experiment 4: One Writer, Multiple Pens, One Paper

Two subjects wrote with four different types of nib pens and then four different ballpoint pens using a single sheet of paper for all. From each group one instrument was selected as "preferred."

OBSERVATIONS

Experiment 1: One Writer, Varying Instruments and Papers

Textured Paper:

The two different grades of textured paper produced very similar results, and therefore will be considered as one type.

The low viscosity, "watery" ink of a nib pen on textured paper flowed readily and uniformly, saturated the superficial layers of fibres, and filled the crevices and fibres at deeper levels in the paper. The texture in this experiment was the densest of all and each of the five writers had a consistently similar pattern (Photos 1-2).

The thicker, syrupy ink of a ballpoint pen tended to adhere to the surface with clumps of ink gathering randomly on the fibres. The deeper layers contained much less ink than in the nib-pen examples. Thus individual fibres in the paper were more cleanly outlined, and there were more clear spaces within the stroke. Typical burr striations were noted. Each of the five writers had the same general internal stroke texture (Photos 3-4).

A felt tip pen produced a stroke pattern that consisted of two tones. A thicker, darker tone adhered to the surface of the paper fibres, and a much paler, more evenly distributed color stained the deeper layers.The surface pattern was due to the more viscous component of the ink; the more fluid base seeped down onto the deeper fibres staining them lightly. Each of the five writers had a remarkably similar stroke texture (Photos 5-6).

The pencil had a distinctive pattern because of the microscopic flaking of graphite particles on the paper surface. The lack of a fluid base left the deeper component of the paper unaffected. The random distribution of surface fibres were neatly outlined by the graphite. There was a distinct likeness in the stroke pattern of all the writers (Photos 7-8).

In each of the above tests a totally distinctive texture in the stroke was effected by each instrument. There was no difficulty in identifying which of the four different patterns was associated with a particular instrument. In addition, every writer generated nearly the exact same set of patterns with each of the four instruments. Minimal variations in the internal form did occur and were consistently related to increased pressure of the stroke. This resulted in compression of the surface fibres, increased release of ink, and a denser version of the typical pattern. Differences in pressure were noted also in the contraction and release strokes for each writer with similar minor changes in the intensity of the patterning. However the basic diagnostic textural features for each writing instrument on this paper type remained unchanged and unique despite pressure fluctuations.

Photo 1. **Writer "C." Nib pen, textured paper, 50x.**

Photo 2. **Writer "G." Nib pen, textured paper, 50x.**

Photo 3. **Writer "M." Ballpoint, textured paper, 50x.**

Photo 4. **Writer "G." Ballpoint, textured paper, 50x.**

Photo 5. **Writer "G." Felt pen, textured paper, 50x.**

Photo 6. **Writer "A." Felt pen, textured paper, 50x.**

Photo 7. **Writer "P." Pencil, textured paper, 50x.**

Photo 8. **Writer "G." Pencil, textured paper, 50x.**

Photo 9. **Writer "G." Nib pen, smooth paper, 50x.**

Photo 10. **Writer "C." Nib pen, smooth paper, 17.5x.**

Photo 11. **Writer "P." Ballpoint pen, smooth paper, 50x.**

Photo 12. **Writer "G." Ballpoint pen, smooth paper, 50x.**

Photo 13. **Writer "P." Felt pen, smooth paper, 17.5x.**

Photo 14. **Writer "M." Felt pen, smooth paper, 17.5x.**

Smooth Surfaced Paper:

This paper is manufactured with a waxy base, no textured fibres, and has virtually no capacity for absorption of ink into the deeper layers. It produced stroke patterns that reflected its hard surface properties.

The ink from the nib pen resulted in an exceedingly dense arrangement. Excess ink either clumped on the surface, or was pushed towards the border of the stroke. All writers had this same stroke texture (Photos 9-10).

The thicker ballpoint-pen ink had a characteristic tendency for thickening the borders of the stroke and leaving the center of the stroke uniformly paler. The ballpoint rotation forced the ink centrifugally on the slippery paper surface towards the edges. There it accumulated leaving a beautiful thick-edged appearance to the stroke. All writers had a comparable pattern (Photos 11-12).

The felt-tip pen left a blizzard of minute, suspended particles within a more lightly stained milieu. All writers had the same distinctive stroke texture (Photos 13-14).

The pencil track was the least dense of all, with graphite particles scattered on the surface interspersed with bare areas. All writers had the same or similar pattern.

As with the results in the textured paper portion of this experiment, each instrument yielded a separate, unique pattern on this paper. Moreover, the pattern for each instrument was entirely different on this paper than it was on the textured paper. Each of the five writers demonstrated the same characteristic pattern with each of the four instruments. Variations in pressure caused minimal variations in the stroke without ever changing its basic attributes.

Experiment 2: Different Writers, Same Instrument and Paper

The stroke texture was surprisingly similar for the 39 people who signed their names using the same nib pen on the same sheet of stationery. The pattern was identical to that of the nib pen on textured paper described above. Variations in the basic flooded pattern were related strictly to pressure. The writers who exerted heavier pressure had a more saturated stroke texture due to an increased release of ink, and compression of fibres. This observation was also noted in the difference between contraction and release strokes in a given writer. The basic texture was the same; the contracted stroke was simply more heavily inked.

The internal ink patterning for the 34 individuals using one ballpoint pen on the same sheet of stationery was the same, and mimicked the pattern for a ballpoint pen on textured paper described above. The woven texture due to outlining of the paper fibres was lighter when pressure was light, and became denser when pressure was increased. As in the nib-pen example above, this observation was noted in contraction and release strokes in a single writer as well as a reflection of pressure differences between writers. In all cases the basic unique identifying features of a ballpoint pen on textured paper remained as a constant irrespective of the effects of pressure.

Experiment 3: Attempt To Change the Texture

The author deliberately set out to change the texture of the stroke using first a ballpoint and then a nib pen. Writing was performed with varying degrees of speed, contraction-release, emotional intensity and determined concentration attempting to visualize and manipulate the tip of pen inside the stroke. Despite multiple attempts to influence the basic texture, each pen reproduced its characteristic internal patterning with total disregard for the efforts of the writer. The texture of the stroke for a given pen and paper is unalterable.

Experiment 4: One Writer, Multiple Pens, One Paper

The ink patterning inside the stroke for the four nib pens was the same except for density differences related to pressure or variable release of ink. The ink patterning inside the stroke was the same for the four ballpoint pens. The patterns for nib and ballpoint differed from each other as noted in Experiment 1.

COMMENTS

In the first experiment the purpose was to note the specific internal pattern constancy or variability if one writer used different instruments and papers. Do we each have our own singular stroke structure, or does it change when the physical factors of varying instruments and paper surfaces change?

The same writer using different instruments on a particular paper surface writes with entirely different stroke patterns with each instrument. Thus the importance of the particu-

lar type of writing instrument as a determinant of stroke texture is established. Secondly, the same writer with the same selection of instruments produces completely new patterns if the type of paper surface is changed. Thus the physical nature of the paper is another element in the formula. Thirdly, all the subjects had virtually the same variations in the patterning. Although the number of subjects was small the reproducibility of the findings was extremely high. Aside from slight alterations due to pressure differences, the input of the individual personality appeared to be negligible in creating the stroke patterns. It was the physical nature of the environment—the pen, ink, and paper that were paramount.

The ink in a nib pen, a ballpoint pen, and a felt-tip pen have remarkably different physical properties. Each ink has its own characteristic manner of clinging to the instrument tip, release from the tip, adherance onto and absortion into various paper surfaces. Within the confines of the paper structure, the movement of each particle of ink is determined by chance physical circumstances. Whether it settles high on a fibre or low in a valley, in the center of the stroke or off to the side cannot be controlled consciously or subconsciously by the writer. The movement of the myriad of ink particles on the paper occurs randomly. Keep in mind that the width of an average stroke is less than one millimeter.

The two paper types selected for this study were deliberately chosen for their markedly contrasting properties. One was a densely compressed, water-resistent, waxy surface with little or no fibrillar content. The other was the more familiar absorbent, textured paper with layer upon layer of randomly directed fibres and myriads of small, haphazardly arranged crevasses and micro-spaces. Each type presented entirely different conditions to the ink as each particle sought its final resting place on the paper. The patterns generated were remarkably dissimilar for each instrument on the two contrasting paper surfaces.

The second experiment was designed to investigate whether important differences in stroke texture would occur when a large number of individuals signed their names on the same paper with the identical pen. This study design automatically eliminated the pen-preference option, but nevertheless seemed to have worthwhile potential. Interestingly, all of the 34 subjects using the same ballpoint pen had an extremely similar pattern in their stroke. The minimal variations that were noted could be ascribed to pressure differences. Thirty four different writers each brought their exclusive personalities into the testing conditions, and yet they all produced one basic pattern. Please remember this refers only to the "texture" of the stroke (examined under at least 16X magnification) and not other aspects of the ductus.

The 39 people who used a nib pen on the same paper all produced a stroke texture characteristic of this instrument and writing surface. Once again the internal structure was practically identical for each writer except for the slight effects of increased or decreased pressure. If personality is a factor in producing texture certainly some differences would be expected in a sample of 39 writers. Other than the variations noted to be correlated with pressure variations there were no such findings. The presence of the three stroke types noted by Pophal could not be identified.

The third experiment confirmed the unalterability of the texture of the stroke in a given individual (*using one instrument on a particular paper surface**). Why does this occur? Is it due to the subconscious expression of personality within the borders of each letter, or is it due to the limitations imposed by the physical forces as the ink spreads over the path of the stroke? If personality plays a major role in the fixation of stroke texture, how does one reconcile this with the significantly different patterns that occur if pen type, and/or paper are changed? The physical forces interacting as we write within that one millimeter wide path seem a more acceptable reason for explaining this phenomenon of unalterability of stroke texture.

Experiment #4 was designed to address the question of the importance of pen selection in relationship to the resultant stroke texture. Pophal stipulated that it was necessary for the writer to choose a pen with which they were comfortable and felt at ease. The resultant writing would then be devoid of inhibitions or restrictions imposed by an instrument that was unfamiliar or caused any uneasiness. This set of circumstances would then result in a more optimized expression of the individual's personality; the validity of the findings in the stroke texture would also benefit from this pen selection process.

The question arises as to what degree the texture of the stroke (for a given writer on a given paper type) is dependent on the pen selection process. If one writes with an device that is "wrong," will the stroke texture be significantly different from that produced by a pen that is "right"?

Experiment #4 examined this question by having two subjects choose one pen from a group of four different nib pens and select another from four varied ballpoint pens. Writing was performed with each of the eight pens on a single sheet of paper. The findings after examination at 16-30x magnification indicated that the stroke texture was the same for all the nib pens; a typical "ballpoint texture" was present for all the ballpoint pens. There was no detectable variation in the stroke texture of the preferred pen when compared to the non-preferreds. Certainly other aspects of the stroke may be affected by pen choice, but this study did not address that issue.

In their classic treatise, Allport and Vernon state that not every expressive movement is directly related to an expression of personality. As examples they offer: exigencies of immediate goal; pathologic or accidental deformation of the body; conditions of health and disease; conditions of the physical environment, e.g., ground and climatic factors in walking or clothes and shape of chair in posture; or *pen, ink and paper in handwriting*** [5].

**author's addition in italics*
***author's emphasis in italics*

CONCLUSION

The results of this study do not support the personality implications of the stroke texture theory of Pophal. The findings suggest that physical forces play the dominant role in creating the texture of the stroke for a given specific combination of pen, ink and paper. The influence of personality was minimal and exerted primarily through variations in pressure. Such effects increased the intensity of the pattern but did not change the basic stroke structure.

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BIOGRAPHY: Alan Levine earned his medical degree at New York University and has been a practicing ophthalmologist since 1965. He studied graphology for eight semesters at The New School for Social Research in New York with Lois Vaisman and Patricia Siegel. He is a charter member and President of the American Society of Professional Graphologists.